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# Wetlands vulnerability assessments in support of management adaptation planning

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National Center for Environmental Assessment, Global Change Research Program

***The views expressed are those of the authors and do not necessarily represent official policy of the US EPA**

# Vulnerability Assessment Partners

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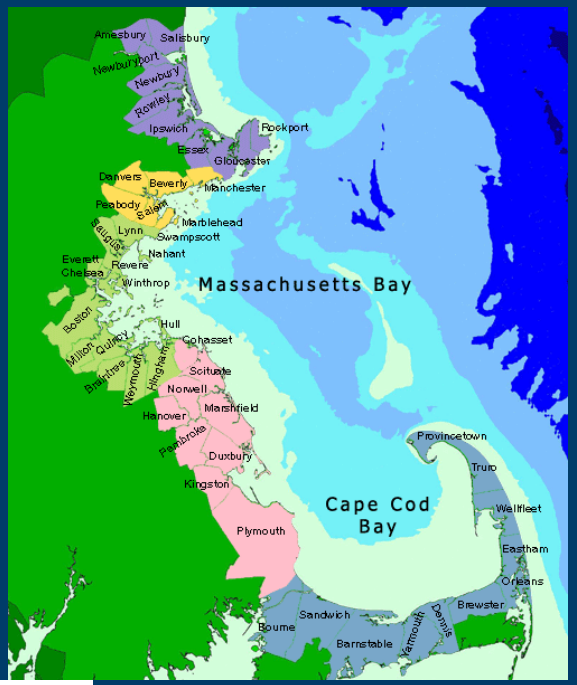


# Vulnerability Assessment Approach

- Select key goals from Comprehensive Conservation and Management Plan
- Create conceptual models for key ecosystem processes
- Assess sensitivities of processes across a range of climate change scenarios
- Assess vulnerabilities of management goals to inform adaptation planning

# Selected Ecosystem Processes

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## MBP Community Interactions: Saltmarsh Sharp-tailed Sparrow nesting habitat



Relationship between native *Spartina* species compared to invasive *Phragmites* for Saltmarsh Sharp-tailed Sparrow nesting habitat

## SFEP Community Interactions: Shorebirds and mudflats



Small bodied Western sandpiper will lose access to mudflat feeding habitat sooner than medium bodied Marbled godwit

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# Assessment Goals

- Improve understanding of the sensitivity of salt marsh and mudflat ecosystems to the projected impacts of climate change
- Improve ability to identify adaptation management strategies that mitigate the impact of climate change, given the uncertainties
- Test the applicability of expert elicitation to this type of analysis

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# What is Expert Elicitation (EE)?

- Multi-disciplinary process using expert judgment to inform decision-making when:
  - ✓ Empirical data are not yet complete
  - ✓ Uncertainties are large
  - ✓ More than one conceptual model can explain available data
  - ✓ Technical judgments are required to assess assumptions
- Results: characterization of the current state of knowledge for the key questions of interest
- This project is not a formal EE, but an innovative approach based on the same principles and elements

*www.epa.gov/spc/expertelicitation/*

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# Objectives

## Elicit qualitative judgments on:

- Relative influences of physical and ecological variables that regulate key climate-sensitive processes
- Sensitivities of influences under
  a) current conditions and
  b) two future climate change scenarios
- Degree of confidence in judgments about these relationships

# Workshop Participants

| MBP Community Interactions Group | SFEP Community Interactions Group |
|---|---|
| **Dave Burdick**<br>University of New Hampshire | **Letitia Grenier**<br>San Francisco Estuary Institute |
| **Walter Berry**<br>Environmental Protection Agency | **Jessica Lacy**<br>United States Geological Survey |
| **Michelle Dionne**<br>Wells National Estuarine Research Reserve | **Michelle Orr**<br>Phillip Williams & Associates |
| **David Johnson**<br>Marine Biological Laboratory | **Stuart Siegel**<br>Wetlands & Water Resources |
| **Gregg Moore**<br>University of New Hampshire | **Diana Stralberg**<br>Point Reyes Bird Observatory Conservation Science |
| **Robert Buchsbaum**<br>Mass Audubon | **Lynne Trulio**<br>San Jose State University |
| **Cathy Wigand**<br>Environmental Protection Agency | **Isa Woo**<br>United States Geological Survey |

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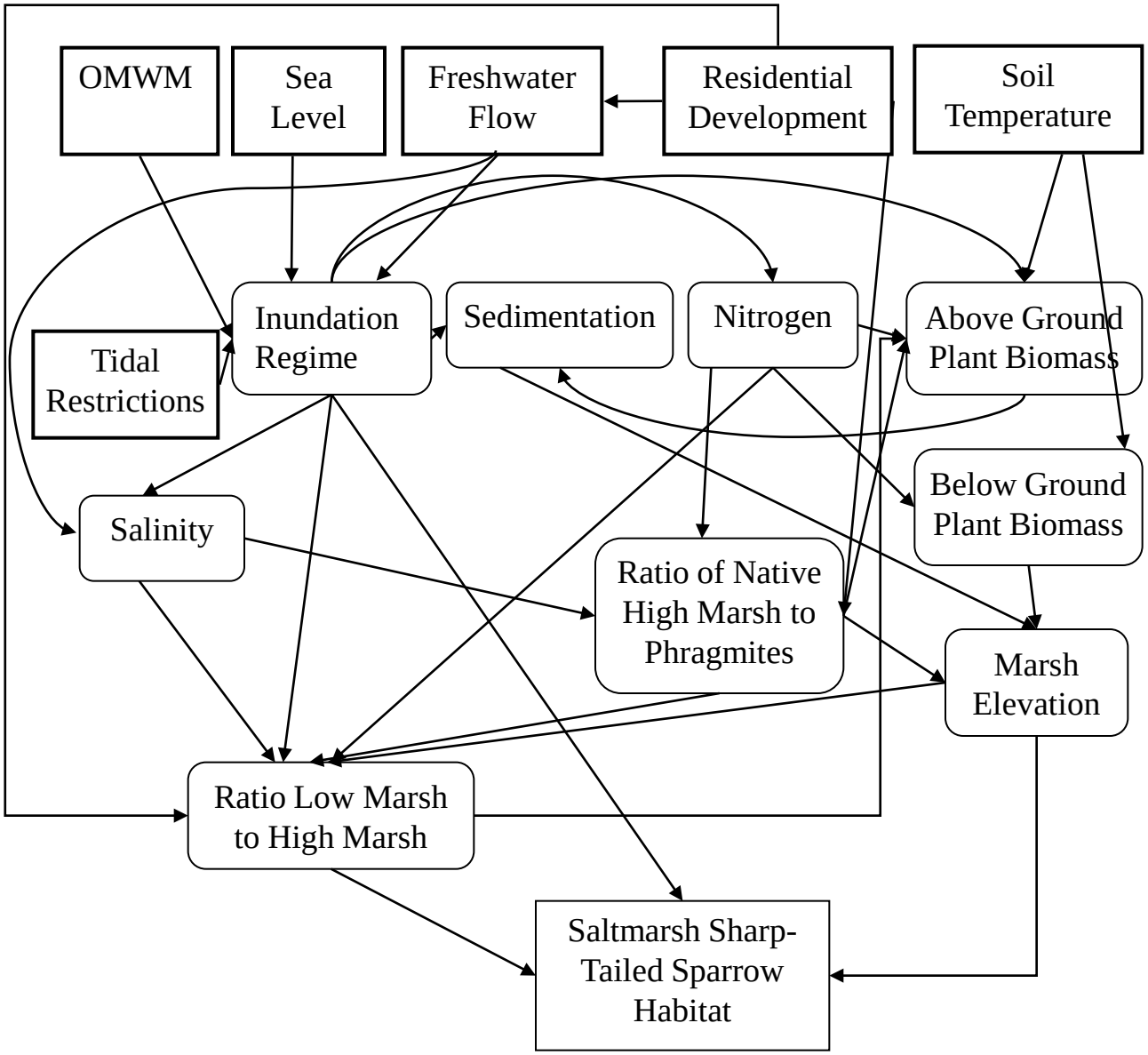
# MBP Group Influence Diagram



# Characterizing Influences

- How well do we understand each influence?
  - ✓ Influence Types: Direct or Inverse
  - ✓ Influence Degrees: Proportional or Disproportional
- How sensitive is each influence?
  - ✓ Low Sensitivity: Disproportionately Weak Response
  - ✓ Medium Sensitivity: Proportionate Response
  - ✓ High Sensitivity: Disproportionately Strong Response
- What influences have the greatest relative impact on the endpoint?

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# Two Mid-century (2040-2069) Climate Scenarios:

- "Lower-range" scenario (a warmer climate, with wetter winters and springs, slightly reduced summer soil moisture and stream flow)

- "Higher-range" scenario (a much warmer climate, with wetter winters and springs, reduced summer soil moisture and stream flow)

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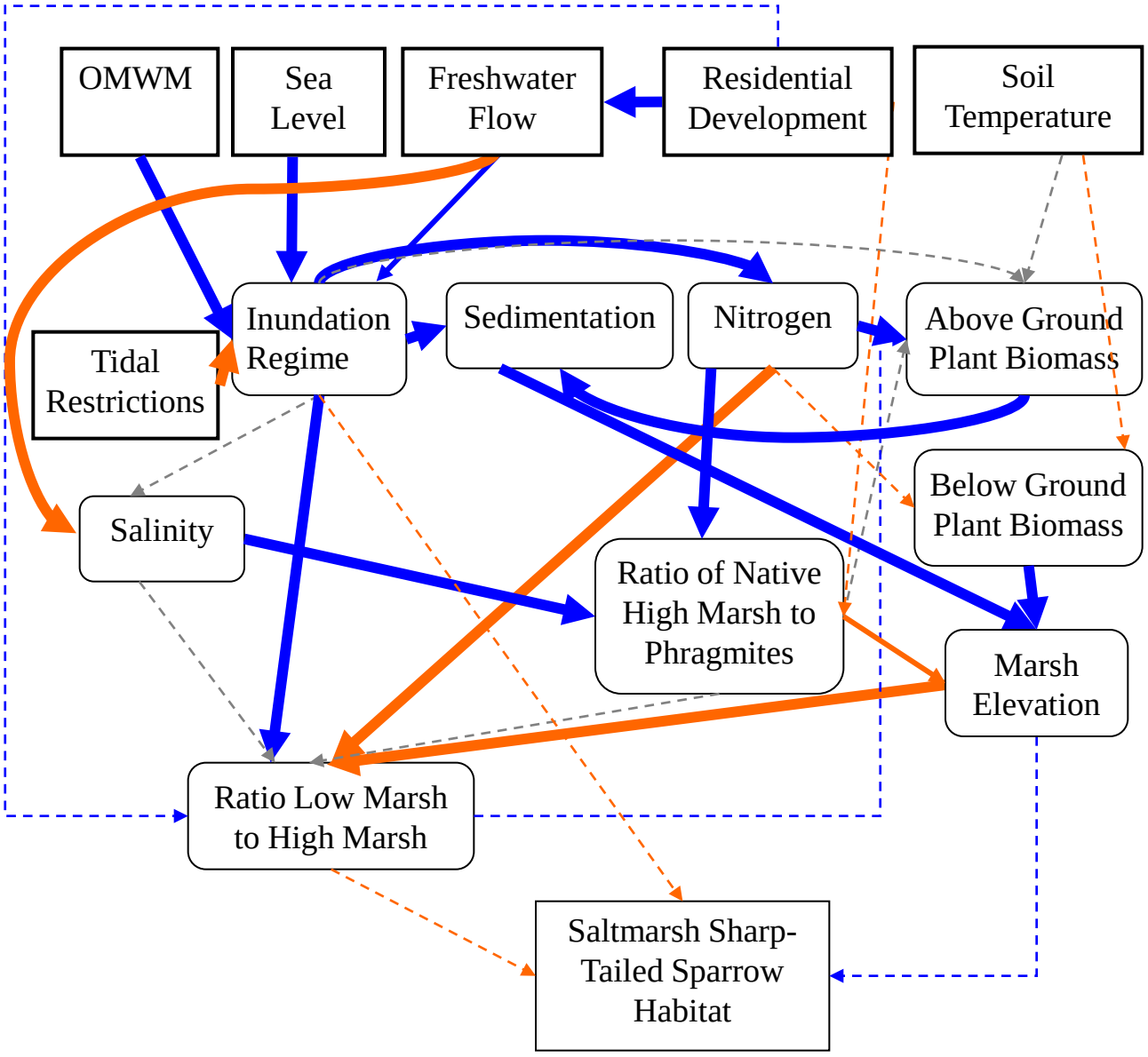
# MBP Influence Type & Degree Current Conditions




Direct
Inverse
Agreement in type only
No agreement

Thickness denotes degree
- proportionate
- disproportionately weak

# MBP
# Influence Type & Degree Future Conditions

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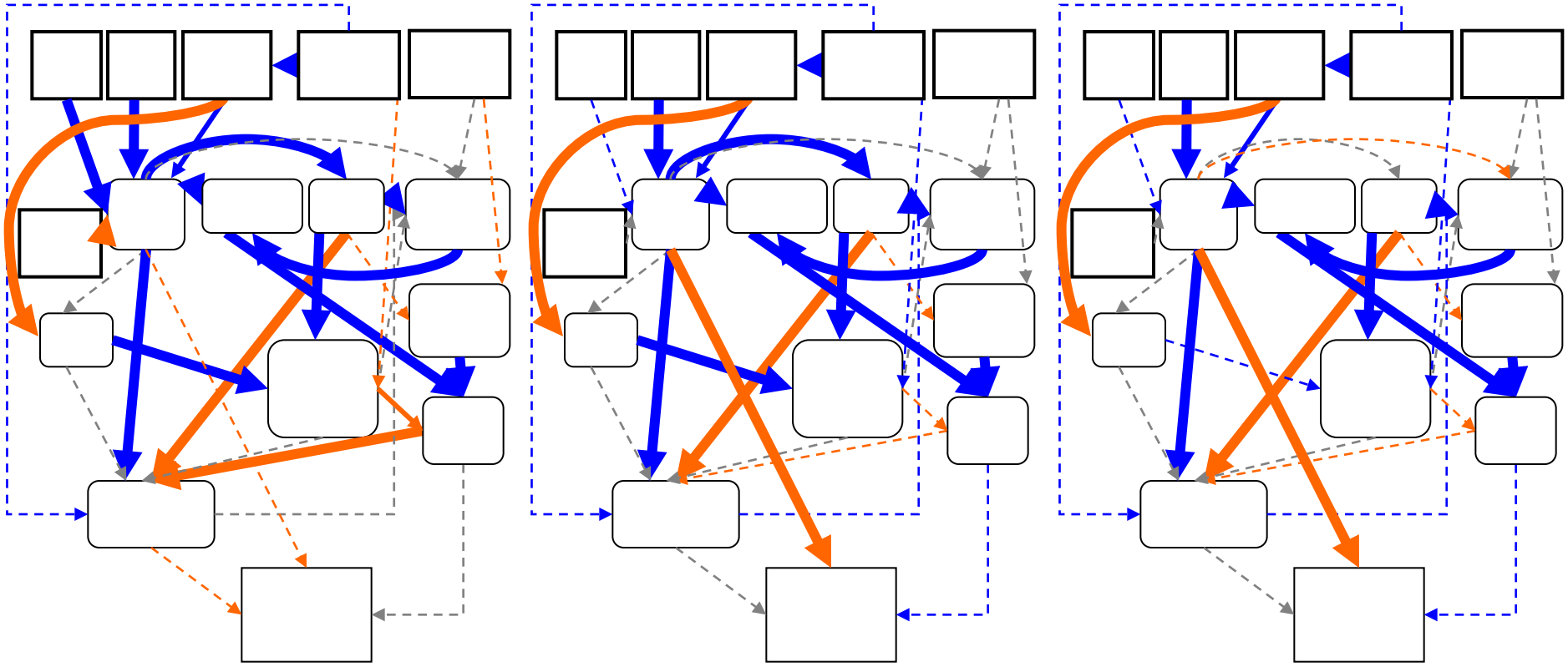
## Current

## Scenario A

## Scenario B



Direct
Inverse
Agreement in type only
No agreement

Thickness denotes degree
- proportionate
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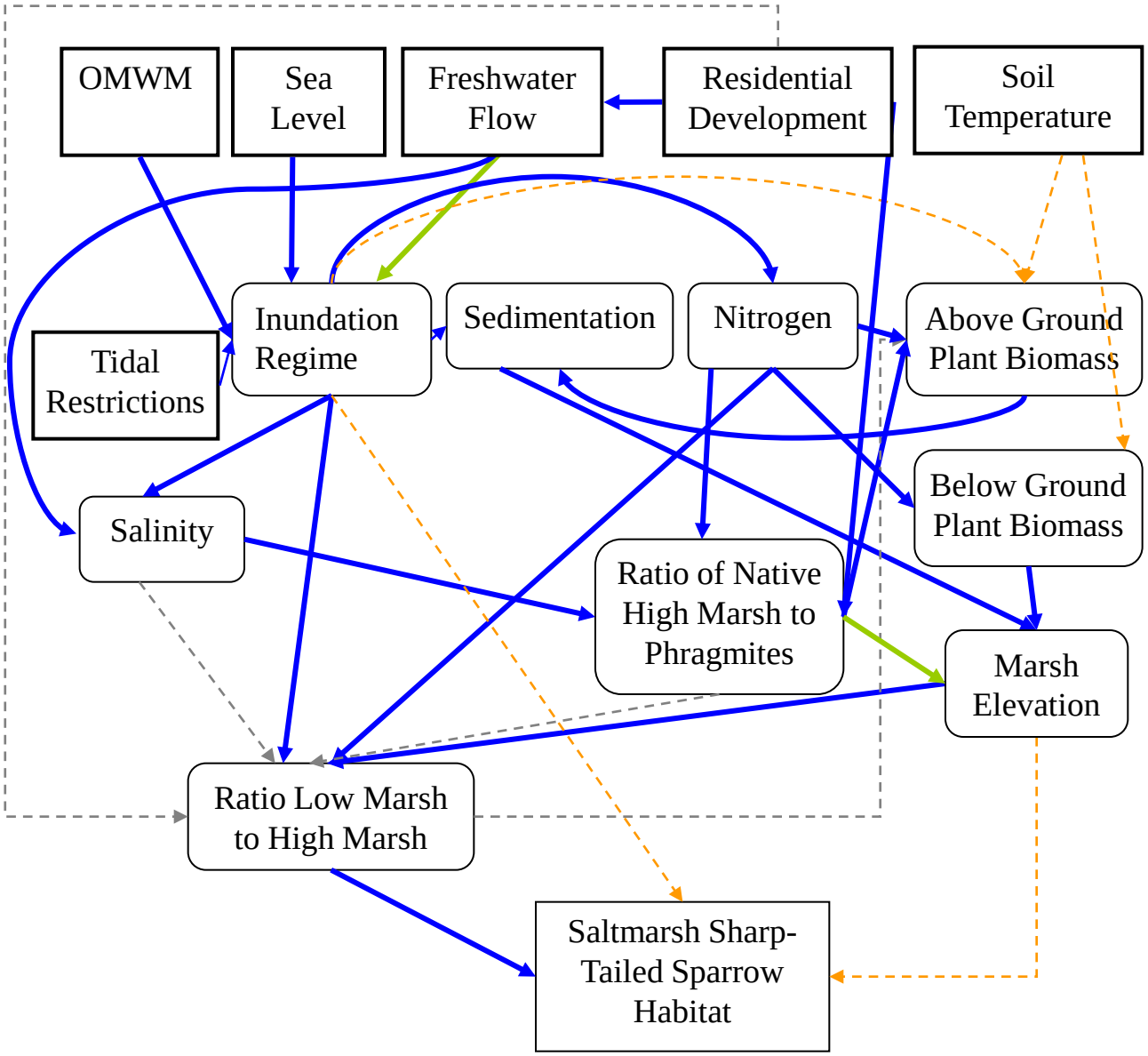
# MBP Sensitivity Current Conditions




- Low sensitivity
- Intermediate
- No agreement
- Intermediate/high mix

# MBP Sensitivity
# Future Conditions

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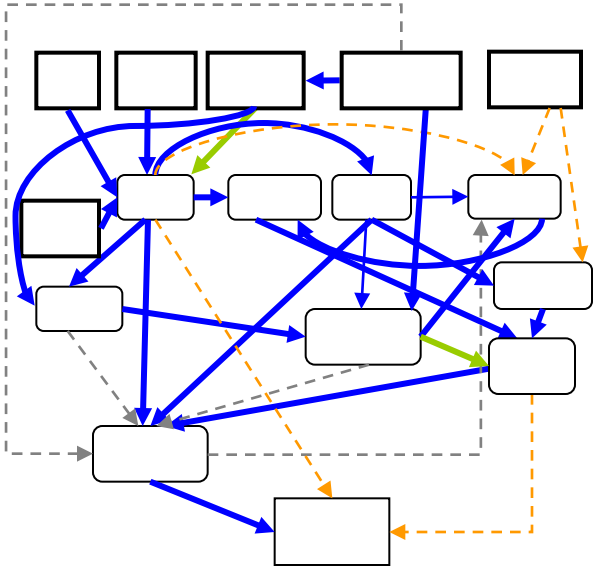
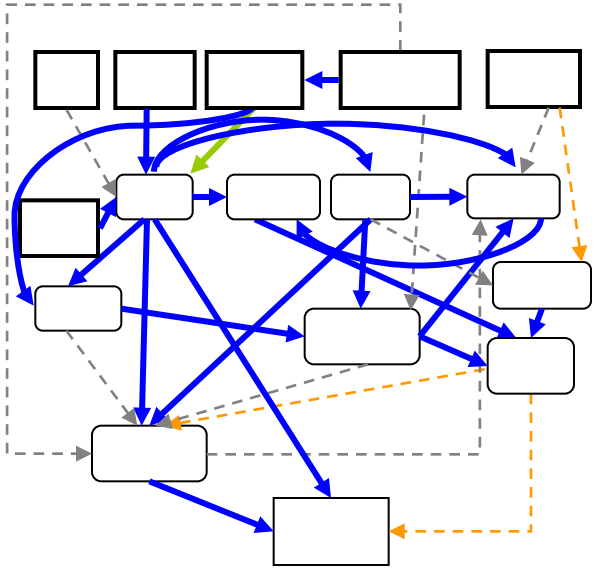
- Low sensitivity
- Intermediate
- No agreement
- Intermediate/high mix

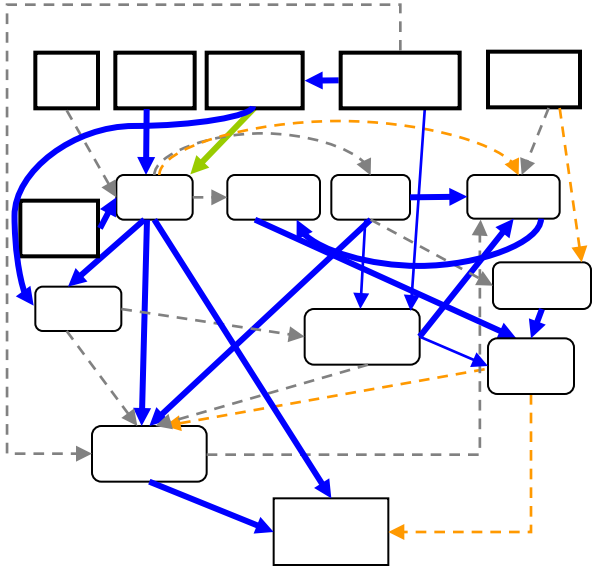
## Current



## Scenario A

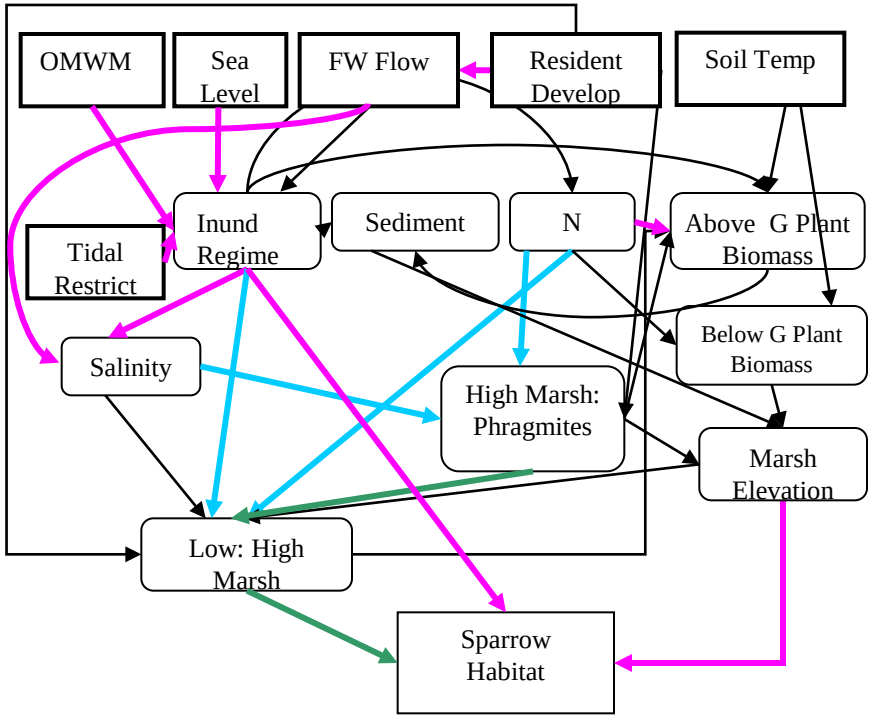


## Scenario B

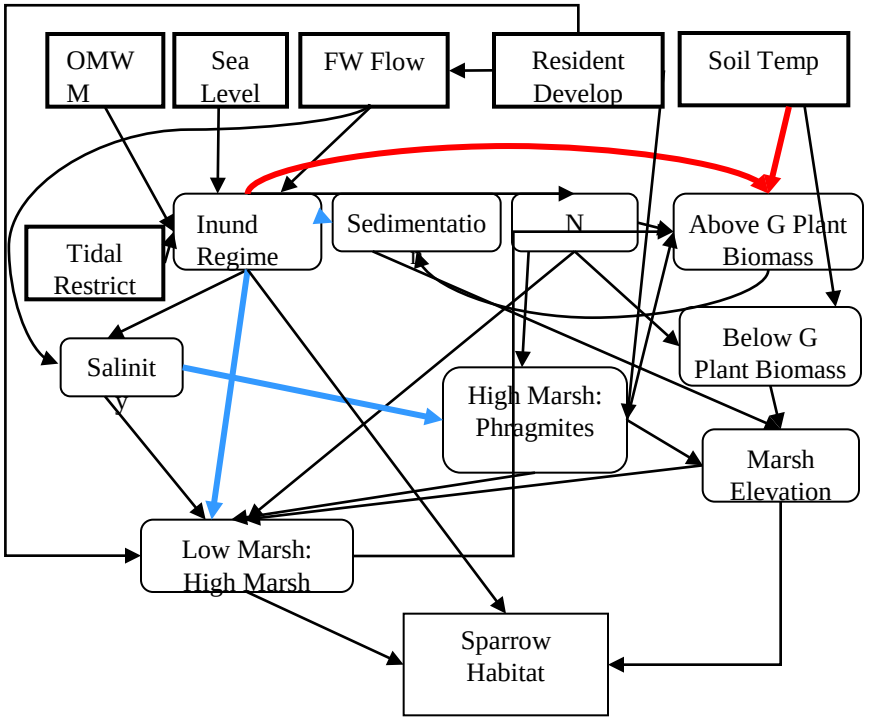


# MBP Relative Impact

## Current



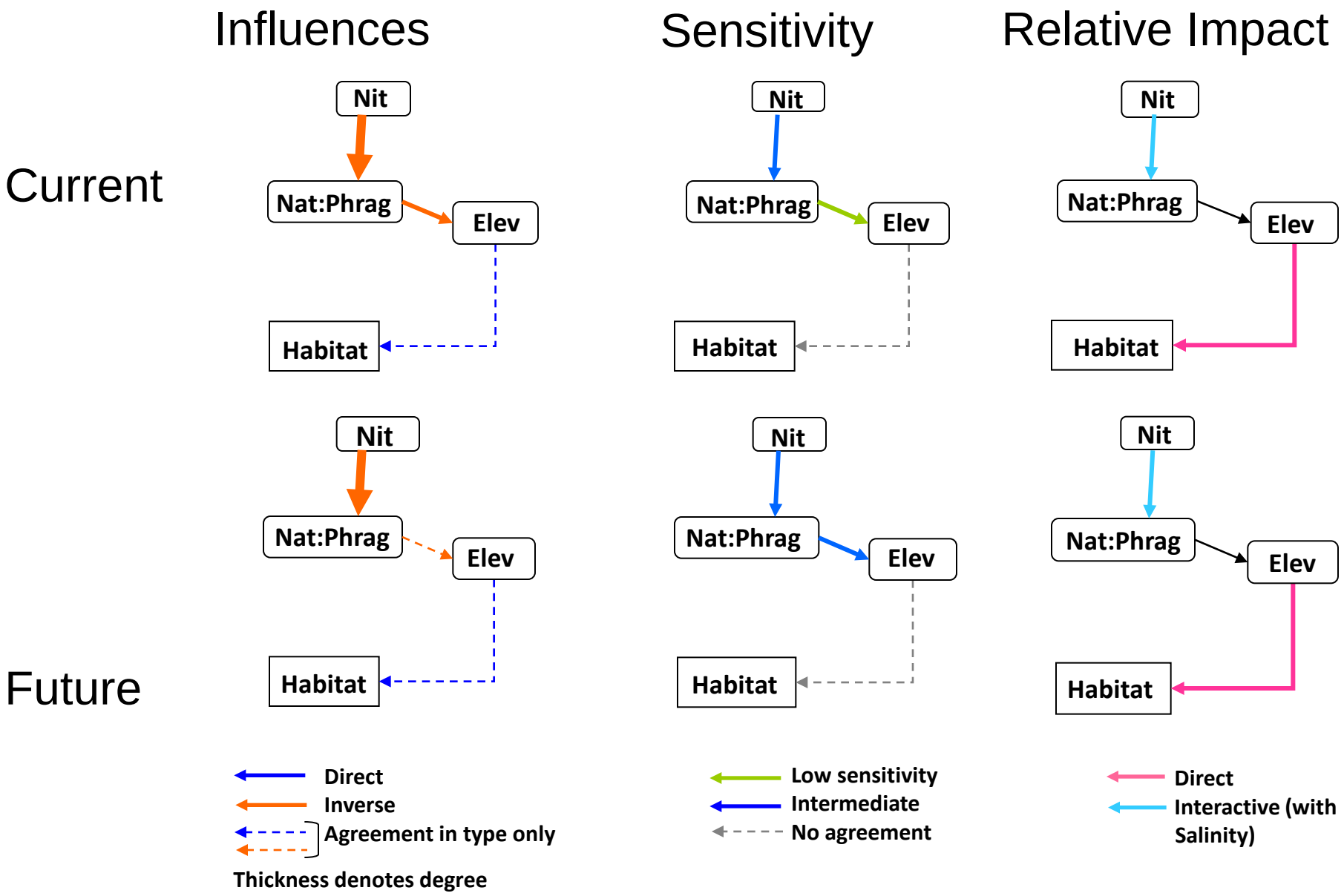

## Future




- Direct and primary importance
- Important interactive influence
- Some agreement on importance

- Interactive influence importance increased under climate
- Influence importance increased under climate

# MBP Example Pathway



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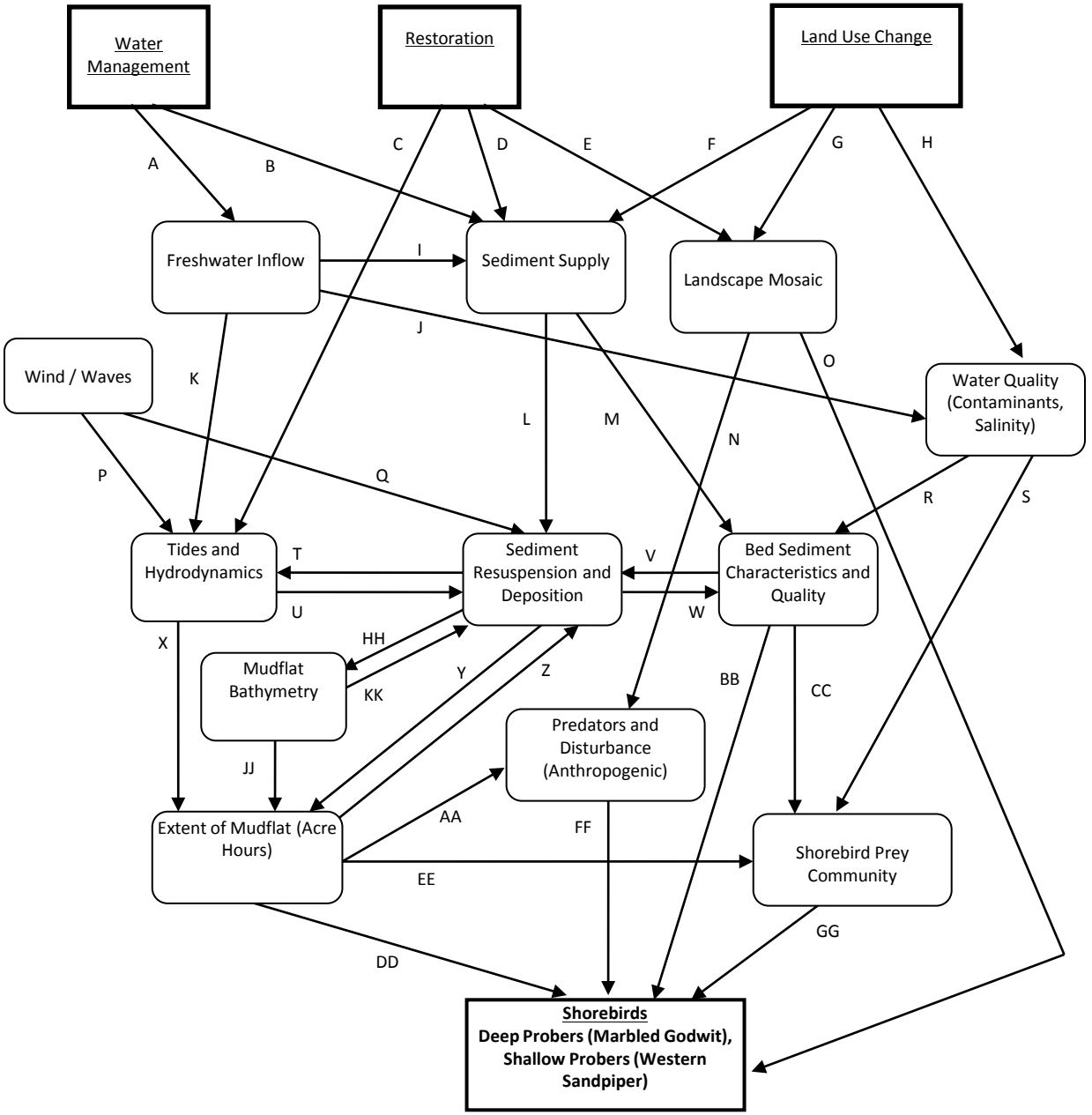
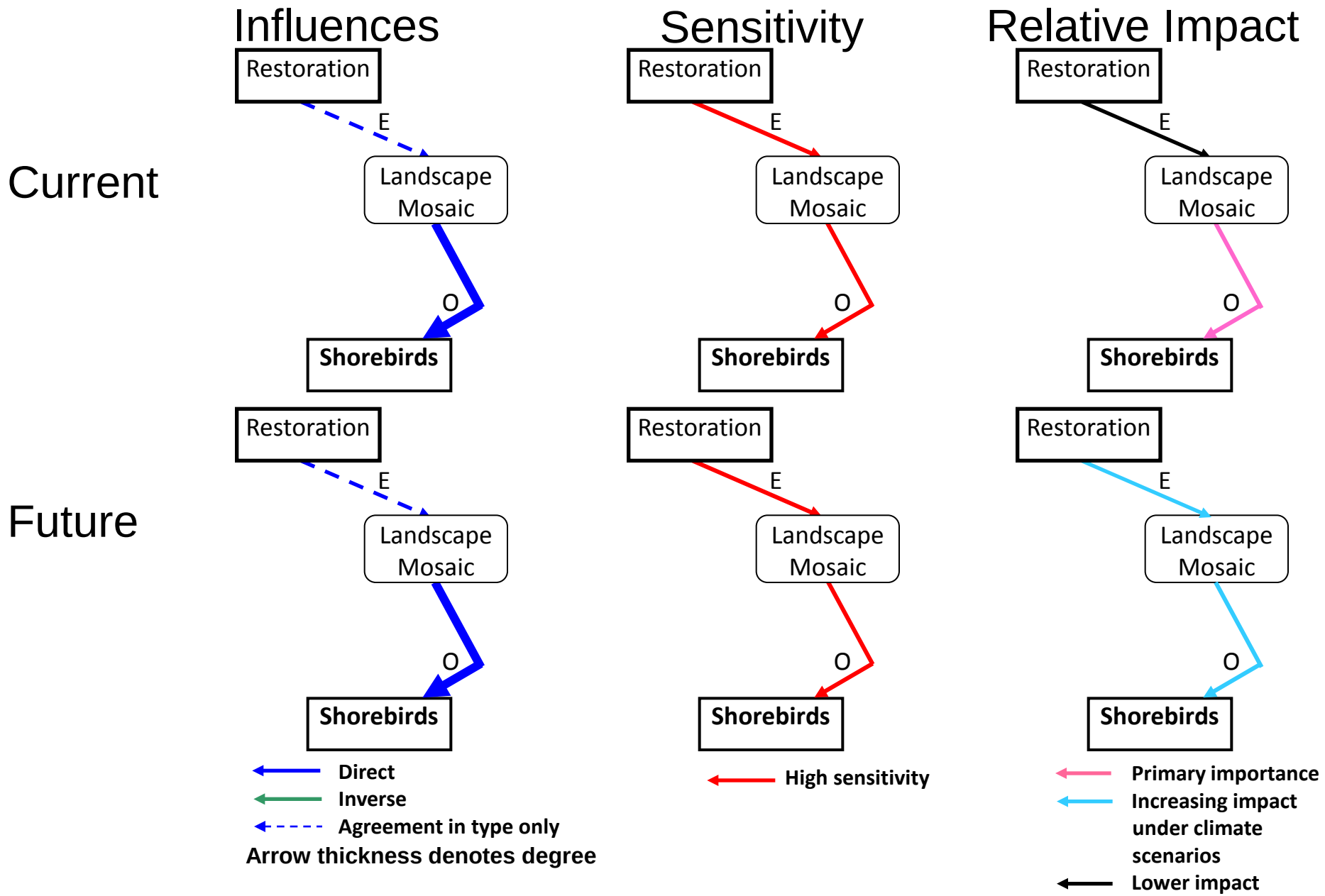
# SFEP

# Group Influence Diagram



# SFEP Example Pathway



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# Management Options

- Restore habitat mosaics, with special attention to threshold landscapes
- Promote absorbent land cover and rain catchers to reduce pollution and erosion
- Remove invasive species
- Ensure adequate sediment supply to promote marsh accretion
- Acquire and protect areas where marsh can migrate upland as inundation increases
- Create “no-wake zones” to reduce erosion
- Control hydrodynamic regime to favor key vegetation types
- Remove tidal restrictions

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# General Results

- It is essential to examine all types of information when analyzing management paths: influences, sensitivity, and importance
- Focus on influences that are well understood, become more sensitive, and have a greater impact under future climate scenarios
- Lack of agreement does not mean zero understanding of influences or zero degree of sensitivity
- Variation between participants was greater than between scenarios
- Thresholds are likely, even though we do not know exactly when they will occur

# Many Thanks

MBP: Jay Baker, Christian Krahforst, Jan Smith, Carole McCauley

SFEP: Judy Kelly, Steve Goldbeck, Sara Polgar

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